ISTITUTO NAZIONALE DI OTTICA
ARCETRI - FIRENZE

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Florence Meeting

on

Problems in Contemporary Optics

Abstracts of the Papers

10 - 16 September, 1954

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AUTHOR INDEX

Friday, September 10, 1954

<u>Session A 1:</u>
"Optics and Information
Theory"

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A. BLANC-LAPIERRE - "Utilisation des méthodes de l'analyse
harmonique et de la théorie de l'infor-
mation pour l'étude de la correspondan-
ce objet-image en optique".

L'auteur compare les propriétés des transformations qui
traduisent le comportement des diverses parties d'un dispo-
sitif optique avec celles de dispositifs radioélectriques
courants. Il est conduit, à propos de cette étude, à ras-
sembler un certain nombre de résultats relatifs à la notion
de cohérence en optique. Ceux-ci sont transposés dans le
domaine radioélectrique.

La notion de bande passante appliquée à l'optique est
discutée en liaison avec celle de pouvoir séparateur ou de
limite de résolution. On étudie la possibilité de corriger
certains défauts dûs à la diffraction. On est conduit à
envisager des possibilités d'amélioration du pouvoir sépara-
teur suggérées par la transposition à l'optique d'idées d'o-
rigine radioélectrique (voir le rapport "Deux expériences
de principe suggerant certaines méthodes pour l'amélioration
de la limite de résolution d'un instrument d'optique" par
A. Blanc-Lapierre et M. Perrot).

Enfin on discute l'introduction d'un élément d'impréci-
sion jouant en optique le rôle du bruit de fond. On est
alors conduit à la transposition à l'optique des principaux
résultats de la théorie de l'information.

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Friday, September 10, 1954.

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A. BLANC-LAPIERRE = M. PERROT - "Deux expériences de principe
suggérant certaines méthodes
pour l'amélioration de la li-
mite de resolution d'un in-
strument d'optique".

L'un des résultats de l'étude de la correspondance entre un
objet bidimensionnel $X [\alpha, \beta]$ (X représente par example
l'eclairement de l'objet au point α, β) et son image (en lu-
mière monochromatique) est le suivant: si faisant l'analyse
harmonique de l'objet, on le décompose en composantes

$$e^{2\pi i [\xi \alpha + \eta \beta]}$$

de fréquences spatiales respectives $[\xi, \eta]$, il résulte des
propriétés de la diffraction que les seules composantes tran-
smises sont celles dont la fréquence spatiale $[\xi, \eta]$ est in-
térieure à un certain domaine borné $\mathcal{D}$ du plan des fréquences
spatiales (composantes $(H)_1$); toute composante (H) pour laquelle
le point $[\xi, \eta]$ est extérieur à $\mathcal{D}$ est éliminée de la transmission
et c'est cela qui limite le pouvoir de résolution.

Si un objet $X_1 [\alpha, \beta]$ ne possède que des composantes $(H)_2$,
il est invisible du côté image. L'existence d'un tel objet ne
pourra être décelée que si on fait apparaitre par un procédé
quelconque un système d'ondes (H), lié à $X_1 [\alpha, \beta]$. Se référant
à des méthodes courantes de radioélectricité on peut penser
faire naître un tel système en remplaçant $X_1 [\alpha, \beta]$ par
$e^{2\pi i [\xi_1 \alpha + \eta_1 \beta]} X_1 [\alpha, \beta]$ (changement de fréquence) ou par
$X_1^2 [\alpha, \beta]$ (détection).

On décrit des expériences de principe à grande échelle
illustrant ces possibilités.

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Friday, September 10, 1954

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Jeanne GAULTIER du MARACHE - "La photographie, filtre de
fréquences".

En général, la photographie est un filtre passe-bas.
Cependant, si l'objet ne contient que de basses fréquences,
la photographie peut créer des fréquences d'ordre plus élévé.
Pour un objet quelconque, des techniques spéciales permettent
d'étendre considérablement le domaine des fréquences transmises,
et même de le prolonger au-dela du domaine des fréquences de
l'objet.

Le rapport entre l'amplitude d'une même fréquence dans
l'image et dans l'objet est en général représenté par une
courbe en cloche, dont la forme est variable. L'allure de
cette courbe peut être totalement bouleversée; quand la pho-
tographie crée de nouvelles fréquences, le rapport envisagé
devient infini; pour un objet périodique, il présente pério-
diquement des valeurs infinies et nulles.

La transmission des fréquences par la photographie dépend
de l'objet, de la nature de l'émulsion et de la technique
employée. La seule qualité de l'objet qui est conservée avec
exactitude est la position relative de ses éléments; c'est à
cette exactitude de position que la photographie doit princi-
palement sa valeur comme procédé d'information.

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Friday, September 10, 1954

<u>Session A 2 :</u>
"Optics and Information
Theory"

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E.H. LINFOOT - "Informational criteria of image quality and
optical design".

The work here described forms part of a joint paper, written
in collaboration with Dr. P.B. Fellgett, on the Assessment of
Optical Images.

The aberration function of an optical system of the usual
kind varies only slowly over its working field; that is to say
the field can be divided into areas, large compared with its
resolution limit, in each of which its aberration function is
substantially invariant. Such an area will be called an iso-
planatism patch.

The imaging of a rectangular isoplanatism patch of a self-
luminous object can be described by saying that each Fourier
element of the intensity distribution $\mathfrak{I}(x,y)$ in the isoplana-
tism patch reappears in the image multiplied by a transmission
factor $\tau(u,v)$ which characterises the optical system and which
vanishes everywhere outside a certain finite region $\mathfrak{F}$ in the
(u,v)-plane (frequency plane). $\mathfrak{F}$ is determined solely by the
aperture of the system; the transmission factor $\tau(u,v)$ is con-
nected in a fairly simple way with its ikonal function.
In the coherent case the results are essentially similar; the
intensity $\mathfrak{I}(x,y)$ is replaced by the complex displacement
function $\hat{E}(x,y)$ on the object surface and $\tau(u,v)$ by a new
transmission factor $\hat{\tau}(u,v)$ which vanishes everywhere outside
a finite region $\mathscr{A}$ in the (u,v)-plane. For the sake of shortness,
only the incoherent case is considered in the present account.

To assess the quality of an image on the basis of the infor-
mation which it contains:,, we need to consider:

(1) the aperture and the ikonal function (or the aberration
function) of the optical system,

(2) the statistics of the "object noise" n_o and of the
"noise" n_2 originating in the receiving surface,

(3) the "spread function" of the receiving surface,

(4) the statistics of the presumed object-set.

It is then possible to formulate the analytical conditions
which the ikonal function of a camera lens must satisfy in
order to maximise the mean information-content of image of
low-contrast objects.

E.H. Linfoot - "Informational criteria of image quality and
optical design". (follows)

Aberration balancing carried out on this basis may be
expected to yield optical designs whose information-passing
capacity on low-contrast objects is near to a maximum for
prescribed aperture and field.

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Friday, September 10, 1954

Session A 2 :
"Optics and Information
Theory"

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G. TORALDO = M.T. ZOLI - "Optical images considered as
stochastic sources".

An optical image can be considered as a source of infor-
mation. One may ask how much information is contained by an
image of a given area, formed by an instrument of a given
resolving power. It would be easy to answer this question if
the visual world had a completely random constitution.
However, due to the statistical relations existing between
the illuminations at different points, the real amount of
information is much smaller. An experimental investigation
has been carried out with a view to discover these statisti-
cal laws. A set of real pictures have been analysed pho-
tometrically point by point and the probabilities of diffe-
rent successions of illuminations have been worked out. It
is hoped that by this procedure it will soon be possible to
evaluate the actual amount of information of an image and
consequently the redundancy of an optical instrument.

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Friday, September 10, 1954   <u>Session A 2 :</u>
                                              "Optics and Information
                                                 Theory"

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G. TORALDO - "Capacity of the optical channel in the presence
                of noise".

This research has been based on the two following points:
1) Most of the applications of information theory to optics
   which have been made so far deal with coherent illumination.
   In this case the utilisation of a number of results obtained
   in the field of radio communication is almost straightfor-
   ward. It seems however more important to set up an informa-
   tional theory of incoherent images, i.e. of what normally
   represents our visual world.

2) The usual definition

   (1) $H = - \int p(x) \log p(x) \, dx$
   for the entropy of a continuous set of messages has let to
   some rather common misunderstandings. Such definition is
   highly conventional, in that an infinite constant is neglected.
   An amount of information evaluated by means of (1) is mean-
   ingless in itself. Only a difference of two expressions
   like (1) can have a meaning. In other words the amount of
   information for a continuous set of messages cannot be com-
   puted unless noise is taken into account.

Starting from these two remarks a theory has been developed
which considers an optical instrument of a given aperture as a
communication channel. Noise is represented by the receptor
having a finite differential treshold.

In the most common conditions the capacity of the channel
turns out to be a universal function of the stray light percen-
tage.

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Saturday, September 11, 1954   Session A 3 :
                                      "Optics and Information
                                       Theory"

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A. MARECHAL = P. CROCE - "Amélioration de la perception des
                          détails des images par filtrage des
                          fréquences spatiales".

On sait que la formation d'une image optique est un filtrage
des fréquences spatiales (la nature du filtrage dépend des aber-
rations, éventuellement de la diffusion dans l'émulsion photo-
graphique etc.)

Il est possible d'observer l'image primaire enregistrée sur
photographie à l'aide d'un appareil fonctionnant en éclairage
cohérent et possédant une courbe de transmission des fréquences
spatiales qui compense les variations de transmission dans
l'instrument initial. On obtient ainsi une amélioration des
contrastes (différente de celle obtenue par renforcement photo-
graphique) qui favorise la perception des détails de l'image.
On présentera quelques exemples de résultats obtenus sur des
objets variés. Il est possible par ce procédé d'atténuer l'ef-
fet d'un défaut de mise au point, d'aberrations etc.

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Saturday, September 11, 1954   <u>Session A 3 :</u>
                                        "Optics and Information
                                        Theory"

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P.M. DUFFIEUX - "La limite du domaine optique d'extension"

Le domaine passe-bas des fréquences linéaires transmises à
l'image peut être limité:

- par la structure grenue de la lumière et des surfaces sensibles;

- par leur structure cellulaire;

- par les aberrations et la disparition de la phase dans l'image d'énergie;

- par l'ouverture des faisceaux.

Cette dernière limite est une coupure sans fluctuations;
tout le problème du grandissement des images est de l'atteindre.

L'objet tridimentionnel est l'invariant de ses images bidimentionnelles. Dan l'espace tridimentionnel de Fourier les
domaines plans d'extension remplissent au plus la sphère de résolution de rayon $2/\lambda$. La fonction de transmission qui remplit cette sphère varie avec le degré de cohérence depuis une
constante unitaire pour la cohérence parfaite jusqu'à la décroissance régulière de l'unité à zero vers les hautes fréquences pour l'incohérence. L'incohérence est une perte
d'information sur l'objet.

L'objet de l'imagerie cohérente est un champ d'interactions
avec la lumière. Il existe pour chaque objet une sphèremaximale de résolution. fixée par le quanta susceptible de le détruire. Il subsiste donc toujours, dans la définition optique
d'un objet, au dela de sa barière mecanique de potentiel, une
auréole de diffraction qui peut être interpretée comme le produit d'un facteur de structure qui dépend du rayonnement utilisé et d'un facteur de convergence qui représente, à distance
suffisante, les champs newtoniens incohérents. Il est probable
qu'au voisinage de la barière de potentiel ce champ doit évoluer vers des champs cohérents superficiels qui représentent
l'aspect optique des phénomènes superficiels connus de la chimie-physique.-

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Saturday, September 11, 1954   Session A 3 :
                                   "Optics and Information
                                   Theory"

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P.M. DUFFIEUX - "Questions posées à la théorie de l'information".

    Le signal, comme, en Optique, l'Objet, est attendu. Sa dé-
finition est la conclusion d'un choix. D'un autre coté la
vue n'est pas seulement un sens d'analyse et de compréhension
mais aussi de contrôle et de suggestion. La distinction des
objets, la troisième dimension de l'espace lui viennent du
toucher et du mouvement dont elle est généralement d'auxilliaire.
L'Optique a toujours été plus ou moins asservie à la Mécanique.
Ce sont ces subjectivités et soumissions qui autorisent à parler
de qualité.

    Telle qu'elle est donnée par D. Gabor ou Blanc-Lapierre, la
Quantité d'Information exige quelques compléments. - Quel est
le rôle de la mise au point dont les solutions proposées sont
indépendantes? - Celui de la cohérence ou de l'incohérence qui
correspondent à deux types de transmission? -Comment peut-elle
évoluer de l'appareil parfait à l'appareil réel? - L'objet sur
lequel informe l'image n'est il pas une projection, en retour,
de l'image? - Comment les images bidimentionnelles s'intègrent-
elles en objet tridimentionnel? - Comment évaluer la quantité
d'information lorsque le renseignement est un "signal" demandé
a l'objet, par exemple une dimension, et non "tout" l'objet? -
Quelle est la définition objective de l'objet?

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Saturday, September 11, 1954   <u>Session A 3 :</u>
                                      "Optics and Information
                                      Theory".

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P. FELLGETT - "An informationally-efficient method for the
              measurement of radial velocities". ·

The raw data yielded by a well-designed physical experiment
contain implicitly a contribution to the answers of the questions
which the experiment was intended to elucidate. The process of
"interpretation" or "reduction" of the data consists in making
these answers explicit. Evidently no new true information can
be added during this process, unless new data are introduced,
and it is undesirable that information should be lost. An
"ideal" interpretative process is therefore one which conserves
the information revelant to the questions with which the experi-
ment is concerned. The efficiency of an interpretative process
can be assessed by comparing the appropriate information content
of the raw data with that of the explicit answers obtained from
them. Woodward and Davis have shown, with particular reference
to radar, that the logarithm of the probability, that a pulse of
known shape is present at a given position in a measured noisy
waveform, is the cross-correlation function between the obser-
ved waveform and the known pulse shape. They also show that
this interpretative process conserves information relating to
the existence and position of the pulse.

Since the information-passing capacity of a physical appara-
tus is limited, it is desirable that this channel capacity
should not be wasted on information which is irrelevant to the
final answer sought. This applies with particular force when
the effects investigated are close to the fluctuation limit of
measurement, as occurs in optics when apparently faint sources,
such as stars, are measured. It is very inefficient, in this
respect, to use a spectrograph to measure detailed multi-dimen-
sional information about the spectrum of a star in order to
obtain finally only a one-dimensional datum such as the radial-
velocity. This information inefficiency is an important reason
why radial velocity measurement in this way requires long expo-
sures and has an unfavourable faint limit. The following me-
thod of overcoming this inefficiency appears to be practicable.

The whole of the spectrum of a star may be regarded as the
"pulse" of the Woodward and Davis theory, and the required
cross-correlation function can be obtained by an optical-analo-
gue method. The spectrum of the star to be measured is focus-

P. Fellgett - "An informationally efficient method for the measurement of radial velocities". (follows)

sed into a previously prepared developed plate of the spectrum of a star of the same type and known radial velocity (the spectral type can be determined photometrically), and the total transmission through the plate is measured photo-electrically as a function of a simulated Doppler shift of the plate relative to the star spectrum. In this way the radial velocity is measured directly at the telescope. The method gives greater weight to lines that are sharper or stronger, and this weighting is ideal in so far as the assumption of the Woodward and Davis theory are fulfilled. A substantial part of the light collected by the telescope reaches the photocell, and this proportion depends very little on the dispersion. Accordingly, it is possible to measure the total effect of a large number of lines which are individually beyond the limit of detection in faint stars or galaxies. The time required to make a measurement of given accuracy depends on the previous uncertainty in the radial velocity, as it must do in an informationally efficient method because the information gain which the measurement represents is itself a function of the a priori uncertainty.

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Saturday, September 11, 1954

<u>Session B 1 :</u>
"Non-Classical Image-
Forming Device"

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A.C.S. VAN HEEL -"Transfer of optical images by means of a
bundle of thin transparent wires".

The light entering the end of one of the wires leaves the
wire at the other end with little loss, provided it is opti-
cally isolated from the other wires. Total reflection at the
walls of each wire takes care of the transfer of the light.

Isolation can be attained by means of a coating with a sub-
stance of lower refractive index. With a proportion of 0,96 for
the indices of coating and core, apertures up to 1 : 1.8 can be
handled.

Applications lie there where the flexibility of the tran-
sporting bundles is of advantage. With suitable irregular
formation two dimensional codation and decodation can be achieved.

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Saturday, September 11, 1954

<u>Session B 1</u> :
"Non-Classical Image-
Forming Devices"

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H.H. HOPKINS = N.S. KAPANY - "Transparent fibres for the tran-
smission of optical images".

An account is given of earlier experiments (Nature <u>173</u>,
p.39 Jan. 2 1954) in which a flexible bundle of fine glass
fibres was successfully used for the transmission of opti-
cal images.

Some more recent photometric and other studies of the
optical properties of fibre bundles will be described, to-
gether with some further applications.

It is hoped that a demonstration will be given.

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Saturday, September 11, 1954

<u>Session B 1 :</u>
"Non-Classical Image-
Forming Devices"

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M. FRANCON - "Application des tubes conducteurs de lumière en
photométrie microscopique".

Afin d'éviter des difficultés au point de **vue** stabilisation
des sources il est avantageux d'utiliser, pour la photométrie au
microscope, la même source pour éclairer la préparation et la
plage de la source de comparaison.

Un dispositif très simple peut être réalisé en empruntant
une partie de la lumière de la lampe et en la "conduisant" au
moyen d'un tube de matière plastique jusqu'au cube de Lummer
situé dans l'oculaire du microscope.

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Saturday, September 11, 1954

LAURA RONCHI - "Fresnel mirrors satisfying the sine condition".

A spherical mirror based on the principle of Fresnel lenses.
is corrected for spherical aberration and sagittal-coma
for any aperture.

The 3rd order aberrations are equal or less than those of
the usual spherical mirrors.

LAURA RONCHI - "Aberrations introduced by a toric section in
a configuration lens".

The geometrical aberrations introduced by a toric connection
in a configuration lens with symmetry of revolution are com-
puted.

Some tables and diagrams give the variations of the focal
length of the principal points and of the spherical aberration
as functions of the parameters of the system. From these
data it is possible to select for each particular system,
the torus which is the most convenient and which are the va-
riations to be applied to the configuration of the system,
in order to render so small as to be negligible the total
aberrations.

Saturday, September 11, 1954   Session B 2:
                                    "Non-classical Image-
                                    Forming Devices".

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G. TORALDO - "Third order correction of a configuration
              system".

A number of configuration lenses for high-speed scanning
have been developed in the last years. Many workers have
looked for lenses effecting a perfect collimation in a mathe-
matical sense. This is much more than is actually required,
as is well known in applied optics, where perfect instruments
are practically never met. A good optical instrument is only
an instrument where the aberrations are smaller than the tole-
rance. A perfect optical instrument, even if it were realizable,
would work no better than a good optical instrument. The same
philosophy can be applied to the design of microwave lenses,
where tolerances are much larger than in optics. To this
end the author has worked out the formulae for the third
order aberration of a configuration lens consisting of two
or more developable surfaces of revolution. It turns out
that the third order aberration can vanish in a number of
cases of practical interest. Some of these lenses have been
constructed and tested with excellent results.

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G. TORALDO - "Perfect configuration lenses of revolution".

A family of configuration lenses of revolution is descri-
bed which collimate the rays from a point feed each on a
cone of a given aperture. Collimation is mathematically
perfect. The R.C.A. "Lamp-shade", the Renihart-Luneberg
lens and the sphere are found to be particular members of
this family. A fourth member is described, which presents
excellent scanning properties. The corresponding lens has
been constructed and tested. The results are in perfect
agreement with the theory.

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Monday, September 13, 1954

<u>Session C 1 :</u>
"3D and Anamorphic Systems"

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W.D. WRIGHT - The perception of depth: the relative influence of
the monocular and binocular factors in three-dimen-
sional pictures".

Retinal disparity, convergence, motion parallax, angular
size, perspective, overlay, sharpness of outline, etc., all
contribute to the perception of distance, and their influen-
ce in normal viewing situations is briefly discussed.

The contribution of these factors in three-dimensional
reproductions and the extent to which they may give conflict-
ing information about the size and distance of objects in the
scene, are then considered. The need is stressed for maximum
possible harmony of the different clues, if a compelling, un-
distorted and unambiguous sense of depth is to be evoked and
if successful 3D pictures are to be produced.

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Monday, September 13, 1954

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A. ARNULF = "Problèmes posés par la projection des images en
            relief".

Une solution possible de la photographie en relief utilise
le principe de la photographie intégrale de Lippman, sous la
forme que lui ont données Ives (parallax panoramagrams), puis
plus tard en France, Bonnet (reliephographie). On examinera,
dans cette communication:

(1) - Comment doit être modifié le dispositif d'Ives pour
      être adapté à l'emploi de films, c'est à dire éviter
      l'effet des déformations de la pellicule et des légers
      déplacements latéraux qui se produisent inévitablement
      dans les couloirs des appareils de prise de vue et de
      projection   (emploi de film gaufré, écrans de prise
      de vue à panneaux cannelés multiples, etc..)

(2) - Quelles sont les limitations imposées à ce procédé
      par la diffraction, les propriétés des émulsion et les
      instruments. D'un point de vue général, on constate
      que:

      (a) La prise de vue nécéssite une longueur de film
          beaucoup plus grande que la cinématrographie
          ordinaire.

      (b) Le film de 35 mm. est trop étroit.

      (c) La disposition des spectateurs dans une salle de
          projection est strictement imposée, d'où résulte
          que le nombre des spectateurs sera beaucoup plus
          limité que dans une salle normale.

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Monday, September 13, 1954

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G. FRANKE - "Anwendung und Korrektion Brewsterscher Systeme".

Das Brewsterschen Prismensystem zur Erzeugung einer verzerrten
(anamorphotischen) Abbildung eignet sich in der einfachen Form
nur für subjektiven Gebrauch. Für eine reelle Abbildung sin
die Bildfehler zu gross. Es gelingt indessen, in einem zwei-
stufigen System und bei geeigneter Glaswahl alle Bildfehler
soweit zu beseitigen, dass eine einwandfreie Abbildung zustande
kommt. Das zweistufige Brewstersche System eignet sich auch
gut zu einer pankratischen Anordnung, wie sie in manchen Fällen
erwünscht ist.

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Monday, September 13, 1954

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A. BOUWERS = B.S. BLAISSE - "New Anamorphic Mirror System".

The application of mirrors as anamorphic systems has the advantages that chromatic aberrations are excluded and that excellent image quality is achieved with only a few optical components.

The fundamental form of the systems to be described consists of two parallel cylindrical mirrors, one concave and one convex, set up under an angle with the optical axis of the projection lens.

The mirrors may be incorporated in a glass rhombohedron with the maintenance of the apochromatic correction. The dimensions of the system can thus be reduced.

This simple system has the favourable effect of correcting the upward curvature of projected horizontal lines in cinema theatres where the projector is directed downward towards the curved screen.

In the case of straight horizontal projection and in that of the taking of squeezed films in combination with a cine-camera this "horizon curvature" is optically corrected and abolished by two methods.

With the first method a second mirror system with opposite distortion is added to the existing set of cylindrical mirrors. With the second method the mirrors are arranged nearly perpendicularly to the optical axis. This is possible by incorporating the cylindrical mirrors in two prisms separated by a thin layer of air at which the light is twice totally reflected and once transmitted.

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Monday, September 13, 1954   Session D 1 :
                                    "Miscellaneous Subjects"

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J.W. PERRY - "Energy relations in monochromator performance".

The formation of a finite image in a spectroscope is consi-
dered as a diffraction phenomenon and relations in terms of
absolute energy distribution are derived for strictly monochro-
matic, broad (resonance) line and continuous sources. The se-
lective effect of an exit slit with variable position is formu-
lated and the total output of a monochromator determined in
relation to its controlling factors for such sources.

Application of the relations deduced are made to investigate
the apparent form of a spectrum line when scanned by a finite
exit slit and photoelectric receiver, and the conditions for a
level, constant-energy peak, free from ripple, to a given accu-
racy are examined. A relation for monochromator output with
spectrally continuous sources, deduced by the writer (1938) on
a geometrico-optical, basis, is confirmed subject to a correction
for diffraction effects here deduced, affecting output and
purity.

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Monday, September 13, 1954

<u>Session D 1 :</u>
"Miscellaneous Subjects"

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D. RICHARDSON -"Modern diffraction gratings and spectrographs".

A brief discussion of the methods that have been successful in producing substantial quantities of top quality gratings will be followed by a review of recent advances in the design of grating spectrographs.

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Monday, September 13, 1954

A.C.S. VAN HEEL - "Observations on the solar eclipse of June 3, 1954, made by the Delft expedition".

ABSTRACT NOT RECEIVED.

Monday, September 13, 1954   Session D 1 :
                                   "Miscellaneous Subjects"

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F. GABLER -"Eine neue Phasenkontrasteinrichtung für das
          Mikroskop".

Vor kurzem hat A. Wilska über eine neue Methode in der
Lichtmikroskopie berichtet, die darin besteht, an Stelle
des orthodoxen Phasenringes einen hochaperturigen Ring aus
Kerzenruss auf eine Objektivlinse aufzubringen und im übri-
gen das so modifizierte Objektiv so zu verwenden, als wäre
es eines der bekannten Phasenkontrastobjektive, also mit
Phasenkontrastkondensor mit korrespondierender Ringblende
usw.

Der Erfolg dieser Methode - hohes Auflösungsvermögen
und ganz hervorragender Bildkontrast - ist unbestritten.

Inzwischen wurde durch interferometrische Messung fest-
gestellt, dass diese Russchichten Phasenverschiebungen in
der Grössenordnung von 90° hervorrufen. Damit ist der
Beweis erbracht, dass die Wilska-Methode mit negativen Pha-
senkontrast und sehr starker Absorption des Phasenringes
arbeitet.

Bei den üblichen Phasenringen hoher Absorption ergeben
sich bekanntlich Schwierigkeiten durch das parasitäre Licht.
Die Russchichten sind natürlich von diesem Fehler frei und
es gelang auch an Stelle des Russringes einen anderen, viel
widerstandsfähigeren Kontrastbelag mit den üblichen Hoch-
vakuumbedampfungsmethoden herzustellen. Wir haben diesen
"Anoptral"-Belag genannt.

Mit diesem Belag wurde tatsächlich ein wesentlicher
Fortschritt in der Phasenkontrastastmikroskopie erzielt.
Dies wird an Hand von Bildern demonstriert.

Es ist aber auch bekannt, dass bei starker Absorption
des Phasenringes die sog. "Inversion" auftritt, so dass
aus den im Bild gesehenen Helligkeitsverhältnissen nicht
mehr mit Sicherheit auf die vom Präparat erzeugten Gangun-
terschiede geschlossen werden kann. An ausgewählten Prä-
paraten wird der Einfluss der Inversion diskutiert und
auch nachgewiesen, dass es bei biologischen Objekten trotz-
dem und zwar nur mit negativem Phasenkontrast, möglich ist,
eindeutige Resultate zu gewinnen.

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Monday, September 13, 1954

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J. PICHT - "Neue Untersuchungen zur Totalreflexion".

Kurze Inhaltsangabe:

Unter Benutzung der vom Vortragenden 1925 angegebenen all-
gemeinen Formel zur wellen-und beugungstheoretischen Behand-
lung optischer Strahlenbündel beliebiger Aberration, d.h.
beliebig deformierter Wellenflächen, wird die Behandlung der
Totalreflexion, u. zw. der total<u>reflektierten</u> Welle durchge-
führt un es werden aus den Ergebnissen dieser Untersuchung
<u>geometrisch-optische</u> Folgerungen über den Strahlverlauf
gezogen.   Dabei zeigt sich, dass für einen zur Trennungsebe-
ne <u>parallel</u> schwingenden Dipol die totalreflektierte Welle
nicht nur sphärische Aberration, sondern darüber hinaus eine
Art Astigmatismus besitzt, während sie für die Strahlung
eines zur Trennungsebene beider Medien <u>senkrechten</u> Dipols nur
sphärische Aberration besitzt. Es werden weitere Folgerungen
mitgeteilt.

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Monday, September 13, 1954

<u>Session D 2 :</u>
"Miscellaneous Subjects"

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W. FRANZ - "On the Green functions of sphere and cylinder".

The problem of diffraction by sphere^or cylinder can be sol-
ved by a series, the terms of which are Bessel functions
of integer order times suitable angular functions. As those
series are slowly converging for large objects, it is useful
to transform them (after Watson) into series' of Hankel func-
tions of complex order satisfying the boundary condition.
The terms of these series are rapidly decreasing in the geo-
metrical shadow, if the object is large compared to the wave-
length, so they can well be used for calculating the propaga-
tion of radio waves on the spherical earth. This is diffe-
rent in diffraction theory: here the geometrically lit region
is of special interest, where the terms of Watson's series
are increasing from beginning , and decreasing and leading
to convergence only after much more terms than are necessary
when using the original Bessel function series. Now the
terms of the Watson series are identical with the "creeping
waves" determined by K. Deppermann and myself from the inte-
gral equations of diffraction theory; they turned out to
creep along the surface of the object and to radiate off
tangentially. But besides of those creeping waves we got
in the lit region a separate term representing a geometri-
cally reflected wave. In this communication I can show,
that it is possible to split off such a geometrical term
in form of an integral also from the Watson series, and
that the rest is a series, whose terms are strongly decrea-
sing even in the lit region. A closer analysis, however,
shows this decrease (here as well as with the original Watson
series) to be due to a semiconvergent character of the series;
later on the terms are increasing again to very large values,
before they decrease finally. To split the diffracted waves
into geometrical and creeping waves is of great advantage for
the practical calculation of wave functions; the single
terms which allow simple asymptotic expansions, are monoto-
nic functions of distance and angle - the extrema of the
real diffraction patterns are completely understood as inter-
ference of geometrical and creeping waves. To treat diffrac-
tion by general surfaces of small curvature it is important
to know the exact creeping waves for sphere or cylinder,
as it is possible to conclude with what amplitudes the creepi-

ng waves are excited at the edge of the shadow of an arbi-
trary surface; their propagation along the surface can then
be calculated by the integral equations.

Monday, September 13, 1954

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C. MORAIS - "Le isomerie vettoriali nel progetto dei sistemi
a duplice riflessione".

La direzione dello spigolo delle due superfici riflettenti
é trovata come direzione unita nell'isomeria vettoriale che
viene a istituirsi fra le due terne di vettori non complanari
rispettivamente oggetto ed immagine.

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C. MORAIS - "Il calcolo vettoriale e le omografie nel calcolo
dei sistemi ottici".

Si studia il raggio luminoso sotto la forma vettoriale

$$P = A + a \, \bar{t}$$

dove:
P ed A sono punti del raggio
a é uno scalare
$\bar{t}$ é il tensore

Il tensore $\bar{t}$ viene espresso in funzione di due parametri
u e v; i fuochi del pennello di raggi, avente come raggio
medio il raggio considerato, vengono trovati studiando le
direzioni unite della omografia $\dfrac{d\bar{t}}{dP}$ che come é noto, é
dilatazione.

Si studiano in seguito le espressioni dell'aberrazione
di un raggio.

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Monday, September 13, 1954　　　　Session D 3 :
　　　　　　　　　　　　　　　　　"Miscellaneous Subjects"

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A. ARNULF = O. DUPUY = F. FLAMANT - "Méthode objective pour
　　　　　　　　l'étude des défauts du système optique
　　　　　　　　de l'oeil."

　　　L'image d'une fente lumineuse formée sur la rétine sert
de source pour étudier le système optique de l'oeil, en uti-
lisant une méthode quelconque de mesure des aberrations, par
exemple une méthode d'ombre. L'image de la fente, devenue
incohérente par sa diffusion dans la rétine, ne conserve au-
cune trace de la distribution initiale des phases qui lui
avait été imposé par la première traversée de l'oeil; les
résultats obtenus ne feront donc intervenir que la seule
traversée au retour du système optique de l'oeil. Par
contre, la sensibilité sera réduite parce que la fente
source est une image élargie par les aberrations, les micro-
fluctuations de l'accomodation et la diffusion rétinienne.

　　　Une des principales difficultés expérimentales consiste
à obtenir une ouverture pupillaire suffisante, en utilisant
une source intense, sans employer de mydriatique; elle a
été résolue en superposant sur le même cliché plusieurs im-
pressions produites par une lampe flash électronique, l'ob-
servateur fixant avec le plus grand soin un point de repère.

　　　Cette méthode montre surtout l'aberration sphérique et
les défauts d'homogénéité; elle est peu sensible à l'astigma-
tusme, bien que l'on puisse constater visuellement l'effet
des fluctuations de l'accomodation.

　　　On présente les photographies et les courbes d'un homme
jeune. Les défauts d'homogénéité sont faibles, et la courbe
d'aberration sphérique ressemble beaucoup à celle d'Ivanoff.

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Monday, September 13, 1954

<u>Session D 3 :</u>
"Miscellaneous Subjects"

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M. FRANCON - "Etude interférométrique des défauts de basse
fréquence dans les états de surface".

Sauf pour les très petits défauts, le contraste de phase
est d'application difficile lorsque l'on veut étudier les
défauts de poli.

Les défauts larges correspondant à des termes de basses
fréquences sont en effet arrétés par la lame de phase.

Nous avons étudié un nouveau type d'interféromètre qui
élimine ces difficultés tout en restant d'utilisation extrê-
mement simple. Il permet d'étudier et de mesurer les défauts
de toutes périodes.

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Monday, September 13, 1954

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H.H. HOPKINS - "Interferometric methods for the study of diffraction images".

The photometric difficulties which are presented in direct measurements are discussed, and it is shown that a wavefront shearing and a wavefront tilting interferometer may be used to study respectively the transmission factors for any optical system with any mode of illumination and the amplitude and phase in diffraction images of point sources.

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H.H. HOPKINS - "Transmission factors for incoherent objects in the presence of a defect of focus".

The integrals expressing the transmission factors corresponding to any focal plane for both circular and rectangular apertures have been evaluated. It is shown that the slope of the transmission frequency curve at zero and limiting frequencies is independent of the presence of aberrations - whether small or not. Curves are given showing the transmission curves for different focal planes for aberration-free pupils.

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Monday, September 13, 1954

<u>S e s s i o n E 1 :</u>
"Aspheric Surfaces"

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K.W. BRITTAN - "A new machine for producing non-spherical
surfaces".

A description is given of a new type of machine for produ-
cing spherical and non-spherical surfaces. The position of
the grinding tool is controlled with respect to the surface
being worked by a cam rotating about the paraxial centre of
curvature of the work. A lever working at a reduction of 40.1
communicates the displacement at the cam to the tool.

Some problems concerning the design of slides and pivots
will be considered and special features of the machine will
be described in detail.

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Monday, September 13, 1954

<u>Session E 1 :</u>
"Aspheric Surfaces"

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J. DEMARCQ - "Sur la réalisation de quelques surfaces
asphériques de révolution."

Principe de la machine de Descartes. Quelques difficultés
de réalisation. Quelques exemples d'application.

Surfaces paraboliques convexes et concaves (résultats
actuels).

Polissage des verres asphériques.

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Monday, September 13, 1954   <u>Session E 1 :</u>
                                    "Aspheric Surfaces".

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R.E. HOPKINS -"Use of aspheric surfaces in optical systems."

Several of the most economical methods for making aspheric surfaces will be discussed. Aspherics made from a few of these methods have been tested on an interferometer. The testing equipment and results will be illustrated.

Aspherics have been used in several optical systems such as camera lenses, eyepieces, and magnifiers. In refracting optical systems the aspherics are primarily used to introduce astigmatism. Several examples of these designs will be described.

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Monday, September 13, 1954

<u>Session F 1 :</u>
"Optical Problems of
Television"

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H.H. HOPKINS - "Objectives of variable focal length".

Some general properties of the Gaussian optics and
aberrations of systems of variable power are discussed.

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Monday, September 13, 1954

<u>Session F 1 :</u>
"Optical Problems of
Television".

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E.H. TRAUB - "Systems of TV film scanning".

ABSTRACT NOT RECEIVED

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Monday, September 13, 1954

<u>Session F 1 :</u>
"Optical Problems of
Television"

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F.I. HAVLICEK - "On a lens of high relative aperture".

Special needs find sometimes commercial optical systems inadequate to the purpose and to avoid lengthy calculations by trigonometrical methods it will be shown how far it should be possible to get with Seidel's theory only and by using trigonometrical methods for final checks. An example will be given.

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G. TORALDO - "The method of the"brightest green".

Color television receivers can be based on different
principles. Either the images of the three fundamental
colors are formed in the same tube, or there are three
tubes, one for each color. In the latter case the three
images must be projected and superimposed on the same
screen.

This can be accomplished by means of a single lens.
An extremely wide aperture is needed for obtaining suffi-
cient brightness on the screen, with such an aperture it
is difficult to obtain a very good resolving power.

Now it is known from experience that: (1) in three-co-
lor projection the resolving power required from the green
image is considerably greater than that required from both
the red and blue images, and (2) the luminance attainable
with the green phosphor is at least four times the maximum
luminance attainable with the red or blue phosphors.

The author's invention consists in utilising the same
projection lens for the three colors but with a lesser
aperture and consequently greater resolving power for green
and with a larger aperture and less resolving power for
both red and blue. To this end a green dichroic mirror with
a hole of suitable size in the middle may be placed in front
of the projection lens. Alternatively green rays may arrive
at the projection lens after reflection on a green dichroic
mirror occupying only the central part of the beam. In this
manner one can utilise a lens having only poor resolving
power, at maximum aperture, provided that the resolving power
is good at about half-maximum aperture.

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Tuesday, September 14, 1954

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Y. LE GRAND - "Physiologie de la télévision en couleurs".

Les procédés actuels de télévision en couleurs utilisent
trois images (rouge, verte et bleue) et afin de ne pas élargir
la bande transmise il faut profiter au maximum des limitations
physiologiques de la rétine; on analyse les données expéri-
mentales relatives à l'acuité colorée, afin de rechercher
quelle finesse il suffit d'assurer à l'image bleue par rap-
port aux autres.

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Tuesday, September 1⁴, 1954   <u>Session F 2 :</u>
                                   "Optical Problems of
                                   Television"

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G.A. BOUTRY - "L'oeil humain devant le spectacle de la
                    télévision".

1. Introduction. Télévision monochrome et Télévision
    en couleur. But et limites du présent exposé.

2. Télévision en couleur par synthèse additive.
    Primaires choisies. Choix de la luminance maximale
    utilisée dans cette étude. Luminance et couleur.

3. Pollution d'un image par "bruit de fond"; pollution
    d'une image par "diaphotie":

    (a) cas de l'image monochrome: pollution des images
                                   fixes, pollution des
                                   images animées.

    (b) cas de l'image colorée: virage des couleurs -
        valeur relative des pollutions admissibles.

4. Télévision en couleur par synthèse additive: le pou-
    voir séparateur de l'oeil. Examen et spectacle de
    télévision.

    (a) comportement de l'oeil vis à vis des composan-
        tes rouge et verte de l'image;

    (b) comportement de l'oeil vis à vis de la composan-
        te bleue.

    (c) le pouvoir séparateur de l'oeil en l'absence des
        constantes de luminance.

    (d) remarques sur l'artifice des "mixed-highs".

5. Papillotage et la reproduction du mouvement.

    (a) rappel des résultats obtenus dans le cas de la
        télévision monochrome.

    (b) télévision en couleur par synthèse additive:
        résumé d'une étude des papillotages.

6. Conclusion: règles pour l'établissement de systèmes
    rationnels de télévision en couleur. Système dit
    "à double programme".

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Tuesday, September 14, 1954   Session F 2 :
                                   "Optical Problems of
                                   Television".

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A. MAHNEKE - "Experimental flicker-fatigue and its possible
              relation to different light/dark ratios."

Exposure of the human eye to coarse flicker has been found
to cause a decrease in flicker-fusion-frequency (FFF)(1,2)

The purpose of the following experiments was to ascertain,
whether exposure of the human eye to coarse flicker of diffe-
rent light/dark ratios alters this decrease.

Results with two subjects, using an electronic flicker
apparatus with automatic frequency variation (3), monocularly
and with an artificial pupil of 0,2 cm diameter, 1,05 lux
retinal illumination, corroborate the previously found decrea-
se of about 10% after 10 minutes of exposure, but no signifi-
cant influence of different light/dark ratios (10%, 50%, 90%
light-time of a cycle).

The decrease and its influence on flicker-fusion determina-
tions are discussed.

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              20:367:1933

2) Berger, C.; Mahneke, A. Visual fatigue and its determina-
              tion by two simple visual tasks.
              American Journal of Psychology Sept. 1954

3) Berger, C; Mahneke, A.; Mortensen, O. An electronic flicker
              apparatus with automatic frequency variation.
              J. opt. soc. America in press.

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Tuesday, September 14, 1954   <u>Session F 2 :</u>
                                     "Optical Problems of
                                     Television"

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G. GIOTTI - "A device for observing television and motion
              picture images".

The optical properties of a simple catoptric device,
proposed by Eng. Luigi Cristiani, are investigated.

After determining the best conditions of use, the
characteristics of the image obtained with the system
are illustrated. The points particularly referred to
are: the apparent magnitude - the plastic effect which
reminds of stereoscopy - the correction of the television
image curvature - and the brightness.

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Tuesday, September 14, 1954   <u>Session G 1 :</u>
                                    "Retinal Problems"

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M.A. BOUMAN - "On foveal and peripheral interaction in
                binocular vision".

Contrast and increment thresholds were measured by pre-
sentation of the teststimulus in one of the eyes, adapting
fields of mutually different brightnesses and colours being
incident in both eyes.

Essentially no influence was found on threshold value
under such stimulation of the opposite eye, the threshold
being equal to the value referring to exclusive stimulation
of the measuring eye.

Periods of dominance of the various stimuli in the con-
scious perception under certain conditions can easily be
recognized. Measurements of increment thresholds under
fluctuating illumination of the opposite eye at various
stadia of the light-dark ratio of such stimulation show
a complex behaviour apparently due to a non peripheral
mechanism.

Some suggestions are made as to a possible influence
of attentional effects on such measurements.

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Tuesday, September 14, 1954   <u>Session G 1 :</u>
                                      "Retinal Problems"

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C. BERGER - "A flicker test of interaction in the human fovea".

Flicker Fusion Frequency (FFF) in human vision has been found to be affected by the illumination of the surrounding field (1,2). The experiments reported here were conducted in order to ascertain, whether such surround-effects depend upon "entoptic stray-light"(3), size of flicker-test and structure of surrounding field.

Experiments with <u>superimposed steady light</u> ("artificial stray-light") show that "entoptic stray-light" plays no significant role. (Fig.2). <u>Image-size of test-area</u> and <u>structure of surrounding field</u> have a decisive influence upon the surrounding field effect on FFF. Illumination of <u>an immediately adjacent white</u> field does not affect FFF, when very large or very small foveal areas are tested (Fig.3). Maximal surround effects for areas around 1' in diameter consist in an increase of FFF with increasing surround-illumination up to a maximum, when surround and test-illumination are equal, decreasing again with further increase of surround illumination.

With increasing illumination of the white part of a <u>mixed black and white</u> surround (Fig.4), FFF increases almost independently of the size of test-field up to the highest surround illumination-levels (4).

Interpretations of the results as due to foveal interaction between different "functional units", inside "receptive field" (5), or between single receptors, the role of "contrast" (6) and artificial stray-light, considering FFF as "visual temporal acuity" or "successive brightness discrimination" are discussed (7).

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                19.351
             2) Lythgoe, R.J. and K. Tansley, Medical Research
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                Cold Spring Harbor Symposia on quant. Biol.
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             7) Geldard, F.A. "The Human Senses", 1953.90.
                New York.

Tuesday, September 14, 1954   Session G 1:
                                     "Retinal Problems"

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A. KUHL - "Visual acuity as a problem in functional
          association of retinal elements".

It is shown, that in measuring visual acuity by the "mini-
mum visible" (circular test) the functional association of re-
tinal elements is identical with that in measuring threshold-
discriminations, whereas in measuring v.a. by the "minimum
legible" (Landolt-ring) and the "minimum separable" (Foucault-
grating) another series of functional association takes place,
differring from the first one about another threshold-discri-
mination.

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Tuesday, September 14, 1954   <u>Session G 1</u> :
                                     "Retinal Problems"

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H. SCHOBER -"Über den Einfluss des Formensehens und des Richt-
            ungserkennens auf die Messung des Auflösungsver-
            mögens des Auges mit Hilfe des Landolt'schen
            Ringes."

     Es ist schon lange bekannt, dass es kein Kriterium für die
Messung des Auflösungsvermögens des menschlichen Auges gibt,
das frei von den Einflüssen anderer Sehfunktionen, vor allem
der Unterschiedsempfindlichkeit und vom Formensehen ist. Der
Landolt'sche Ring stellt unter allen zu diesem Zweck benutzten
Zeichen neben den Foucault'schen Streifen zweifellos das beste
Mittel dar. Die vom Vortragenden an einer grossen Anzahl von
Messungen gemachten Beobachtungen über die Fehlerverteilung
lassen den Schluss zu, dass auch noch auf eine andere Grund-
funktion des Gesichtssinnes, nämlich das Erkennen von Richtun-
gen besondere Achtung zu legen ist. Die wirkliche Ringstell-
ung wird am häufigsten um 180° falsch angegeben und zwar una-
bhängig davon, ob der Schlitz vertikal, horizontal oder in
schräger Richtung liegt. Offenbar ist die Richtungserkennung
eine Grundfunktion, die sogar noch früher eintritt als das
Formensehen.

     Sobald ein Lichtreiz entdeckt wird, versucht der Gesichtsinn
eine Annahme über seine Lage im subjektiven Sehraum zu machen.
Die Bedeutung der frühzeitigen Richtungserkennung erscheint
begreiflich, weil die Blickbewegungen nur nach der Lage des
gesehenen Objektes im Gesichsfeld gesteuert werden können.

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Tuesday, September 14, 1954   Session G 2 :
                               "Retinal Problems"

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R. GRANIT — "Centrifugal and antichronic effects on the
              retina".

The Horsley-Clarke stereotaxic orientating instrument
has been used to stimulate locally in the brains of cats whi-
le records have been taken with microelectrodes from the
animals retinal ganglion cells.

The frequency of the retinal spikes can be diminished or
increased by some seconds of repetitive stimulation in either
of two places in the brain:

(1) the reticular system in the brain stem
(11) the end points of the optic nerve fibres in the geni-
     culate body, pretectum or superior colliculos. In the
     latter place the centrifugal effect presupposes backward
     or antichronic stimulation of the optic nerve fibres.
     Slides will be shown to demonstrate these effects.
     Their relation to the centrifugal fibres of Cajal will
     be discussed.

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Tuesday, September 14, 1954   Session G 2 :
                                     "Retinal Problems"

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A. MANFREDI - "Fosfeni rotatori per stimolazione con correnti
              alternate".

L'autore riassume le risultanze delle ricerche del Motokawa
sulla stimolazione per mezzo di correnti alternate a bassa fre-
quenza dell'apparato visivo umano. Passa quindi a descrivere
i fosfeni che si generano per applicazione di due correnti
alternate ai due apparati visivi di un soggetto.

Quando le due correnti hanno frequenza poco differente
appaiono fosfeni a strie luminose che si spostano lungo
archi di circonferenza.

L'autore presenta infine grafici relativi all'andamento
del fenomeno.

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Tuesday, September 14, 1954

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W.A.H. RUSHTON - "Changes in rhodopsin density measured ophthal-
                  moscopically in man and animals during light
                  and dark adaptation".

When the fundus oculi is observed through an ophthalmoscope,
the image is observed in light which has passed twice through
the rhodopsin of the retina. Rhodopsin density change can
therefore be measured by accurately determining the fraction
of incidence green light which is reflected back from behind
the retina. One method of doing this is to use a flickering
light, where half a cycle is green and half orange. The re-
flected light is received upon a photo-multiplier tube and
the output is seen in general to be different for two lights.
By adjusting a magenta optical wedge in the input beam, the two
photocell outputs may be equalized. Any change in rhodopsin
upsets the equality, which is restored by resetting the wedge.
In this way rhodopsin changes are read off directly from the
wedge settings after suitable calibration. A measurement
takes about 15 sec. to make. Curves have been obtained for
light and dark adaptation in various conditions, and values
have been found for the fraction of light absorbed by rhodop-
sin in the dark adapted state, and for the retinal illumina-
tion at which the rhodopsin level begins to fall.

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W.D. WRIGHT -"The role of stray light in glare and contrast
            phenomena".

The effect of glare source in lowering the luminosity of
a nearby object has been attributed in recent papers (for
example, G.A. Fry and M. Alpern, J. Opt. Soc. Am., 43, 189,
1953) to the effect of scattered light in the eye, in con-
trast to the suggestion of Schouten and Ornstein (J. Opt.
Soc. Am., 29, 168, 1939) and others that physiological
processes in the retina (perhaps some form of inhibition)
may be responsible. The evidence for these two theories is
reviewed and discussed in relation to the more general study
of contrast phenomena.

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F. FLAMANT -"Contribution à l'étude des distributions d'éclai-
rement des images rétiniennes."

On a employé au début une méthode subjective, mais qui
n'a pas permis de fixer l'ordonnée correspondant au maximum de
la courbe de l'image d'un point. On a ensuite utilisé une
méthode objective, consistant à photographier l'image rétinien-
ne d'une fente d'éclairement variable, obtenu en plaçant de-
vant elle un coin photométrique. L'image obtenue est très fine;
on diminue beaucoup l'effet de la granularité de l'émulsion
utilisée, en opérant sur une photographie composite obtenue
à partir de 10 clichés originaux.

(1) On a obtenu une courbe moyenne pour 7 observateurs: cette
    courbe diffère beaucoup d'une figure de diffraction étant,
    en particulier, bien plus étalée à la base.

(2) La forme de cette courbe peut être retrouvée par le calcul,
    en combinant l'effet d'une distribution d'éclairement
    par diffusion suivant la loi de Lambert, et d'un défaut
de mise au point produisant un écart de $\lambda/2$ sur la surface
    d'onde, et correspondant aux microfluctuations de l'acco-
    modation.

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LUCIA RONCHI - "On the additivity of light stimuli on the
                                retina".

By means of a so called pupil sensitometer, the Stiles
and Crawford effect for a single observer has been measured.

By plotting the log of pupil efficiency against *square* absissae
of points of entry an approximately straight line is obtained.
It is of interest to evaluate the slope of this line.

By using a mydriatic the value of the slope is found to
be nearly half the value obtained without dilating the
observer's pupil.

The integrated Stiles and Crawford effect has been measu-
red for the same observer. From some preliminary experiments
coherent stimuli coming from different points of the pupil
and overlapping on the same retinal area seem to be additive.

Other measurements, concerning the same problem, have
been performed by the same observer by means of an experimen-
tal device involving a flicker photometer.

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S.S. BALLARD - "A program of research in the visual detectabi-
                 bility of distant objects".

A University of California laboratory devoted to basis
research on the limiting capabilities of the human observer
to detect distant objects seen through the atmosphere or
through ocean water has been established at the Scripps
Institution of Oceanography, La Jolla, California. Photome-
tric data on a wide variety of objects, and the laws of image
transmission by the atmosphere or by sea water, are combined
with data describing the limiting performance properties of
the human observer to predict those circumstances under which
a given distant object can be seen. Field experiments under
carefully measured atmospheric and lighting conditions have
demonstrated the validity of this procedure. Scientific by-
products of this program include a study of the penetration
of daylight into the sea and its relation to ecological pro-
cesses in the ocean.

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M. AGUILAR = J. OLIVA - "Distribución de las unidades sensoriales
                        en la retina extrafoveal".

En esta comunicación investigamos la simetria circular de la
retina extrafoveal en un campo de 60° en lo que se refiere a la
agudeza visual intimamente relacionada con la distribución de
las unidades sensoriales en la misma.

Los resultados obtenidos nos permiten comprobar la existencia
de esta simetría junto con el aumento en el tamaño de las unida-
des sensoriales y consiguiente decrecimiento de la agudeza vi-
sual a medida que nos alejamos de la fóvea.

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J.M. OTERO = J. CASAS - "Sobre la teoria de anteojos nocturnos"

   Se investigan las condiciones de aumento de visibilidad
nocturna cerca del umbral absoluto en la detección de manantia-
les puntuales y extensos, observando a través de instrumentos
telescópicos.

   Cuando el ángulo subtendido por el estímulo es muy pequeño
intervienen fundamentalmente los fenómenos de difracción más
ó meno modificados por la presencia de aberraciones; pero al
salirse de manantiales puntuales o casi puntuales comienzan a
jugar un papel preponderante las leyes óptico-fisiológicas que
relacionan los umbrales con el área del estímulo.

   La influencia decreciente de este área al aumentar al ángulo
permite determinar para cada caso los aumentos más favorables
y el límite más allá del cual el instrumento de observación
deja de ser útil al disminuir la luminancia del estímulo sin que
esta disminución pueda ser compensada por el efecto de los
aumentos.

   Se dan tablas y fórmulas empíricas para calcular constantes
geométricas de los anteojos nocturnos más convenientes en cada
caso.

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A. BIOT — "Remarques sur un phénomène signalé par M. Toraldo di
          Francia".

On résume d'abord les résultats publiés jusqu'ici. (Il
s'agit de l'observation d'un champ lumineux uniforme à travers
un trou percé dans un écran opaque tenu devant l'oeil).

On rapporte ensuite ceux auxquels on est arrivé en plaçant
une lampe entre l'oeil et le trou, celui-ci n'étant pas au point.
On remarque, en particulier, que si après une observation –
faite de préférence sur un fond bien éclairé – on porte le regard
sur le fond, on aperçoit une tache sombre correspondant à l'en-
droit de la rétine adaptée aux éclairements observés dans le trou.
Cette observation explique la différence de luminosité, constatée
entre la région centrale et la région périphérique. On peut
aussi s'en servir pour expliquer l'anneau clair qui a été décrit en
tenant compte peut-être d'un effet de contraste.

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A. FIORENTINI - "L'influence des gradientes d'éclairement
                rétiniens et de leurs variations sur la
                sensation subjective de brillance".

Le même effet qui a lieu lorsque on regarde un champ uni-
forme à travers d'un trou circulaire placé près de l'oeil, a
été observé aussi en regardant la penombre d'un objet éclairé
par une source étendue: près du bord du champ éclairé on voit
une ligne très brillante.

On a prouvé que cette ligne a une origine purement subjecti-
ve et on a mis en relation ce phénomène avec celui découvert
par Mach (1865) en des conditions un peu differentes. L'effet
est produit par une soudaine variation du gradient d'éclaire-
ment sur la rétine.

On a cherché à déterminer la relation entre la brillance du
champ et le gradient minimum qui permet de percevoir la ligne
brillante.

En suite on a étudié l'influence du temps d'observation sur
la visibilité de la ligne; on a trouvé qu'elle est moins aisé-
ment visible lorsque le temps d'observation devient inférieur
à 1 seconde.

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R.W. DITCHBURN - "Eye movements in relation to retinal action".

It is assumed in many theories of retinal action that the
response of a receptor is determined by the intensity of the
light falling upon it. Some theories assume that the response
of a receptor is at least partly determined by the rate of
change of intensity of the light falling upon it.

If the second type of theory is correct eye-movements play
an important part in determining the response of the eye to a
given stimulus. A technique for studying the response when
the image on the retina is stationary is described and this
gives evidence in favour of the second type of theory.

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A. FIORENTINI = A.M. ERCOLES - "Recherches sur le rôle des
                                petits mouvements des images
                                par rapport à la rétine."

En utilisant une méthode suggérée par Ratliff et Riggs on a
trouvé que le pouvoir séparateur de l'oeil, ainsi que le pouvoir
de perception d'un fil, décroit lorsque on empêche les mouvements
des images par rapport à la rétine, qui seraient dus aux petits
mouvements de l'oeil.

Le même fait a été mis en évidence partant d'un autre point
de vue. On a mesuré le pouvoir résolvant en regardant un réseau
subjet à un mouvement harmonique autour de sa position de repos.
On a fait varier la fréquence de ce mouvement dans un certain
interval.

Le pouvoir séparateur devient plus petit au fur et à mesure
que l'amplitude angulaire du mouvement augmente. Mais la perte
de visibilité des traits du réseau est toujours petite par rap-
port à la diminution du contraste due au mouvement.

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A. MANFREDI - "Nuovo metodo di sensitometria visuale obbiettiva."

L'autore descrive brevemente i principi sui quali si basa il rilievo del riflesso psicogalvanico e quello, da lui recentemente introdotto, del riflesso psicovoltaico. Passa quindi ad illustrare come, attraverso questi rilievi, sia possibile misurare, in modo obbiettivo, la acuità sensitiva di un qualunque organo di senso e come ciò venga fatto correntemente in campo audiologico per la determinazione della acuità uditiva, in particolare dei residui uditivi nei bambini sordomuti. Riferisce quindi delle prime esperienze fatte da lui e di quelle fatte in collaborazione con il Prof. L. Fiori-Ratti per l'applicazione del metodo nel campo della sensitometria visiva.

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E. INGELSTAM - "Possible interpretations of the ultrastructure
                of retinal receptors".

ABSTRACT NOT RECEIVED

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